SUPPORT FOR THE AMENDMENT

This Amendment amends the specification by rewriting the Abstract as a single paragraph; cancels Claims 2-3 and 7-10; amends Claims 1, 4 and 6; and adds new Claims 11-13. Support for the amendments is found in the specification and claims as originally filed. In particular, support for Claim 1 is found in canceled Claims 2-3 and 9, and in the specification at least at page 7, lines 3-8 and 15-17, and in Examples 1-2. Support for new Claims 12-13 is found in the specification at least at page 8, lines 20-22. No new matter would be introduced by entering these amendments.

Upon entry of these amendments, Claims 1, 4-6 and 11-13 will be pending in this application. Claim 1 is independent.

REQUEST FOR CONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

Applicants thank the Examiner for the courtesies extended to their representative during the personal interview on February 27, 2008. Applicants thank the Examiner for the indication during the personal interview that the amendments appear to "overcome outstanding objections to specification and claims and 35 USC § 112 rejections". Interview Summary dated February 27, 2008.

As discussed in the personal interview, $12CaO \cdot 7Al_2O_3$ (i.e., $C_{12}A_7$) is expected to be useful as an oxidation catalyst, an ion conductor or the like, because this calcium aluminate can contain oxygen radicals such as O_2^- or O^- as active oxygen species. Specification at page 1, lines 7-9, and page 2, lines 19-23. Although films of $C_{12}A_7$ are desirable, $C_{12}A_7$ films made by conventional sintering processes are expensive; $C_{12}A_7$ films made by conventional physical vapor deposition (PVD) methods and sol-gel methods are amorphous and do not

include oxygen radicals without additional thermal processing; and crystalline $C_{12}A_7$ films made by conventional chemical vapor deposition (CVD) methods at high temperatures tend to peel from substrates during cooling or undergo cracking. Specification at page 3, line 9 to page 5, line 6.

The present inventors have found that $C_{12}A_7$ films having high concentrations of oxygen radicals can be formed by a thermal spraying method in which crystalline $C_{12}A_7$ powder having a high oxygen radical concentration is thermally sprayed and deposited on a substrate as a crystalline film of $C_{12}A_7$ having a high oxygen radical concentration. Specification at page 5, lines 7-14. The reason as to why in the present invention a calcium aluminate film including oxygen radicals at high concentration can be satisfactorily obtained by a thermal spraying method is not necessarily clearly understood. Specification at page 10, line 26 to page 11, line 3. However, the present inventors believe that during the thermal spraying the $C_{12}A_7$ particles having a high oxygen radical concentration are melted only at the surface or in the vicinity of the surface of the particles and thereafter solidified on the substrate, whereby the composition and the crystal structure of the starting material are likely to be reflected in the film. Specification page 11, lines 2-3 and 22-27, page 12 lines 1-2.

Claims 1-5 are rejected under 35 U.S.C. § 103(a) over U.S. Patent Application Publication No. US 2002/0172726 ("Hosono") and in view of U.S. Patent No. 5,391,440 ("Kuo").

Hosono discloses $C_{12}A_7$ containing a concentration of oxygen radicals of 10^{20} cm^{-3} or more. Hosono at abstract. Hosono's $C_{12}A_7$ is produced by reacting raw material in a solid phase reaction. Hosono at [0010].

However, the Office Action admits that the Hosono does not disclose "the thermal spraying of the powder of the calcium aluminate material". Office Action at page 6, lines 14-15. The Office Action relies upon Kuo for disclosing thermal spraying.

Kuo discloses thermally spraying a mixture of $LaCrO_3$ particles and flux particles of calcium aluminate, $(CaO)_{12}\cdot(Al_2O_3)_7$. Kuo at column 9, lines 1-6.

However, the cited prior art fails to suggest the independent Claim 1 limitations "depositing the thermally sprayed powder onto a substrate as a film comprising deposited crystalline $12CaO\cdot7Al_2O_3$ ($C_{12}A_7$) having an oxygen radical content of at least 10^{20} cm^{-3}".

Furthermore, there is also no reasonable expectation that Hosono and Kuo would lead the skilled artisan to the invention of independent Claim 1.

Hosono discloses that when $C_{12}A_7$ is heated at 1200°C or more under an oxygen partial pressure of 10^4Pa or less, the active oxygen species or oxygen molecules will be released from the compound. Hosono at [0015].

Kuo discloses that upon thermal spraying the flux particles of $C_{12}A_7$ form a transient liquid phase. Kuo at column 10, lines 9-11; column 10, line 67 to column 11, line 3. Kuo also discloses that the melting point of $C_{12}A_7$ is about 1600°C. Kuo at column 11, lines 3-4.

Thus, during Kuo's thermal spraying the temperature of the liquid $C_{12}A_7$ will be at least about 1600°C, which is much higher than 1200°C.

It is well known in the art that 1 atm = 101325 Pa, and that air contains about 21 mol% O_2. Thus, air at atmospheric pressure contains about $2.1x10^4$ Pa O_2.

Kuo discloses that among thermal spraying techniques, plasma arc spraying can be used. Kuo at column 12, lines 33-34. Kuo discloses that in plasma arc spraying a carrier gas of nitrogen, argon, hydrogen, helium or the like can be used. Kuo at column 12, lines 33-50. To act as a carrier gas, Kuo's carrier gas of nitrogen, argon, hydrogen, helium must contain much less than $2.1x10^4$ Pa O_2.

Kuo also discloses that thermal spraying can be by flame spraying. Kuo at column 12, line 55. Kuo discloses that flame spraying can be used with flames generated by oxyacetylene torches. Kuo at column 12, lines 55-59. Because the oxygen in an

oxyacetylene torch will react with acetylene before reaching high temperatures, the partial pressure of O_2 during Kuo's flame spraying must be much less than $2x10^4$ Pa O_2.

Thus, Kuo discloses thermal spraying at temperatures much higher than 1200°C and oxygen partial pressures much less than $2x10^4$ Pa O_2.

As discussed above, under these conditions Hosono discloses that active oxygen species or oxygen molecules are released from $C_{12}A_7$.

Thus, there is no reasonable expectation that Kuo's thermal spraying of Hosono's $C_{12}A_7$ would lead the skilled artisan to independent Claim 1's deposited crystalline $C_{12}A_7$ having an oxygen radical content of at least 10^{20} cm^{-3}.

Note that, because Kuo's thermal spraying is performed under conditions in which Kuo's $C_{12}A_7$ flux particles are melted to form a liquid phase, the independent Claim 1 limitations that "the thermal spraying melts the powder only at the surface of the powder or in the vicinity of the surface of the powder" and "a film comprising deposited crystalline $12CaO{\cdot}7Al_2O_3$ ($C_{12}A_7$) having an oxygen radical content of at least 10^{20} cm^{-3}" are not inherent (i.e., necessarily present) in the cited prior art.

Because Hosono in view of Kuo fails to suggest all the limitations of independent Claim 1, and there is no reasonable expectation of success, the rejection under 35 U.S.C. § 103(a) should be withdrawn.

The Abstract is objected to. To obviate the objection, the Abstract is rewritten as a single paragraph.

Claim 6 is objected to under 37 C.F.R. § 1.750(c) as being in improper form. To obviate the objection, Claim 6 is amended to depend from singly dependent claims.

Claims 1-2 are rejected under 35 U.S.C. § 112, first paragraph, because assertedly the specification, while being enabling for the use of calcium aluminate wherein the main mineral phase is crystalline $12CaO{\cdot}7Al_2O_3$ (as described in Claim 3), does not reasonably

provide enablement for use of any oxygen radical containing calcium aluminate in general. The $C_{12}A_7$ feature of Claim 3 is incorporated into independent Claim 1. Thus, the rejection under 35 U.S.C. § 112, should be withdrawn.

Claims 1-5 are rejected under 35 U.S.C. § 112, second paragraph. To obviate the rejection, Claim 1 is amended to recite "depositing the thermally sprayed powder onto a substrate".

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

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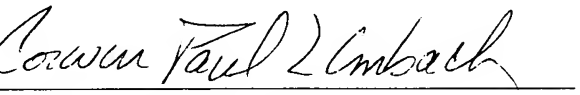

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